

DOCUMENT RESUME

ED 212 914

CE 031 606

AUTHOR Butler, Martha A.; Dickens, John W.
TITLE Caring for an Established Lawn. An Instructional Unit for Teachers of Adult Vocational Education in Agriculture.
INSTITUTION Kentucky Univ., Lexington. Div. of Vocational Education.
SPONS AGENCY Kentucky State Dept. of Education, Frankfort. Bureau of Vocational Education.
PUB DATE 81
NOTE 50p.
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Adult Education; Adult Farmer Education; *Agricultural Education; Behavioral Objectives; Continuing Education; Educational Resources; Horticulture; Learning Activities; Learning Modules; *Lesson Plans; *Ornamental Horticulture; Postsecondary Education; *Turf Management; Vocational Education; Young Farmer Education

ABSTRACT

This unit was developed as a guide for use by Kentucky teachers in planning and conducting adult classes in lawn care. Although primarily intended for use by horticulture instructors, the material could be used with young farmers and/or adult farmers and their spouses. The unit contains four lessons covering the following topics: conducting cultural practices for an established lawn; fertilizing and liming an established lawn; correcting common established lawn problems; and renovating an established lawn. The lesson format was designed to assist teachers in using problem-solving techniques and the discussion method. Each lesson contains an objective, problem and analysis, outline of content, and suggestions for teaching the lesson, including enrichment activities, suggested materials, and suggested resource persons. Transparency and hand-out masters are contained in each lesson, and a list of references to be used with the unit is included in the package. (KC)

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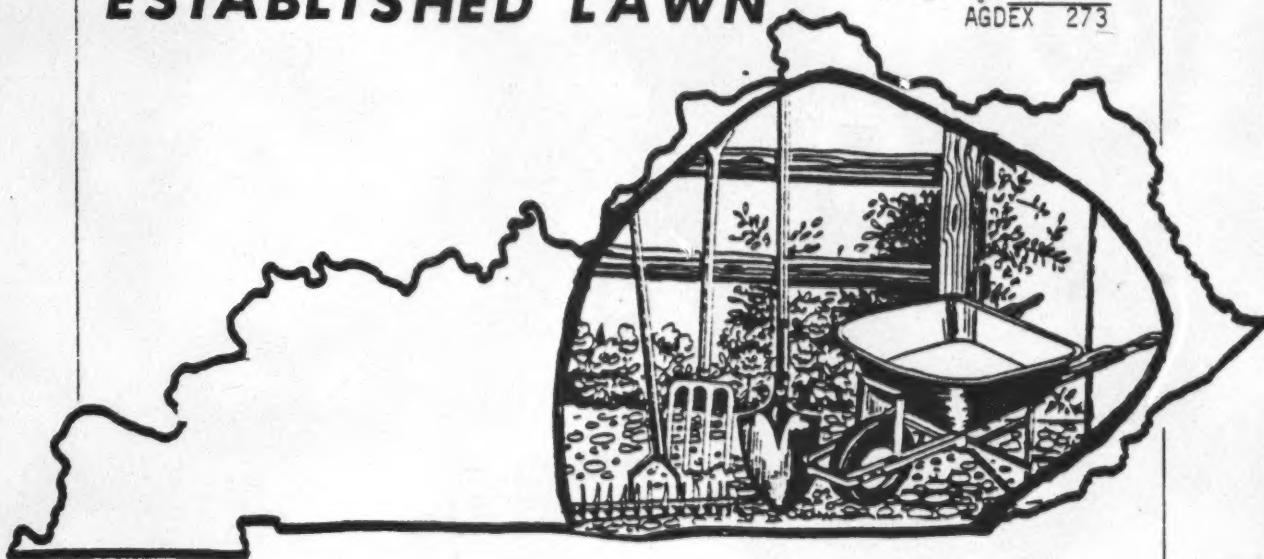
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Caring for an ESTABLISHED LAWN

ADULT 118

File: Ky. _____
AGDEX 273



AN INSTRUCTIONAL UNIT for TEACHERS of ADULT VOCATIONAL EDUCATION in AGRICULTURE

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Department Of Vocational Education
College Of Education
University Of Kentucky
And The
Research Coordinating Unit
Bureau Of Vocational Education
Kentucky Department Of Education

1981

CE031606

CARING FOR AN ESTABLISHED LAWN

An Instructional Unit for
Teachers of Adult Education in Agriculture

Prepared by:

Martha A. Butler
Graduate Research Assistant
University of Kentucky

and

John W. Dickens
Assistant Professor and Project Director
University of Kentucky

Supported by:

Research Coordinating Unit
Bureau of Vocational Education
Kentucky Department of Education

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ACKNOWLEDGMENTS

We are grateful to the following for their valuable assistance with the unit: Mrs. Phyliss Dedman, for typing the manuscript; Dr. A. J. Powell, extension professor (UK), for technical assistance; and to the teachers who reviewed the manuscript.

Appreciation is expressed for the work done by Shirley R. Howard and Maynard J. Iverson in Lesson 6--"Establishment and Maintenance of Lawns"--from the 1973 adult unit, Home Beautification. This lesson was the starting point for this unit. The appropriate Gardening and Grounds-keeping modules, developed by Steve Davis, were also used in preparing these materials.

Expressed appreciation is also extended to Mr. Robert L. Kelley, Director, Agribusiness Education, Bureau of Vocational Education, and Mr. Lou Perry, Coordinator, Research Coordinating Unit, Bureau of Vocational Education, for financial support during the development of this manuscript.

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The content in this report does not necessarily represent that of the College of Education, University of Kentucky, or the Bureau of Vocational Education, Kentucky Department of Education.

SUGGESTIONS FOR USING THE UNIT

This unit of instruction was developed as a guide for use by teachers in planning and conducting adult classes. Although primarily intended for usage by horticulture instructors, the material could be used with young farmers and/or adult farmers and their spouses. It is recommended to have multiple copies for class members usage of the major reference, How To Have a Beautiful Lawn, and many of the Cooperative Extension publications listed in Appendix A, the "Unit References" section of the manuscript. These publications should be shared with class members at the appropriate time in each lesson. Information for securing these materials is given in Appendix A.

The unit has four lessons, but may be expanded to more topics or utilized in diversified courses for shorter periods of instruction. Lessons 3 and 4 could be easily combined into a single class session. It may be helpful to involve class members at the organizational meeting in the selection of lessons and activities.

The format used was designed to assist teachers in utilizing problem-solving and the discussion method. A teaching procedure that has been used successfully is as follows: Step 1: The teacher lists the topic (problem and analysis) on the chalkboard. Step 2: He then sets the stage for discussion with introductory facts, ideas, or comments, using items from the section on "developing the situation." Step 3: The teacher calls on the class to give their experiences, ideas, and knowledge concerning the subject. The discussion is supplemented with handouts, transparencies, models, or other inputs gathered by the teacher beforehand to help solve the problem under consideration. Resource people or films may also be used here as sources of information. (Transparency and handout masters are found at the end of each lesson in the unit.) Step 4: When the facts have been brought out and a good discussion has taken place, the teacher leads the group to appropriate conclusions. These summary statements are written on the chalkboard and, in some cases, are typed up and distributed as handouts at the next meeting. Some instructors will utilize devices such as panels, exhibits and tours to reinforce the conclusions reached. Several suggestions for supplementary enrichment activities are listed in each lesson of this unit. Step 5: Opportunities should be given for class members to practice the skills discussed in each lesson, either at the individual's home or at a special location.

Teachers may want to utilize the wealth of resources found in each community to supplement their teaching--local nurserymen, area Extension Specialists, newspaper garden editors, Garden Clubs of Kentucky representatives, and others will undoubtedly be pleased to serve as resource people, furnish samples, give demonstrations, conduct tours, arrange for films and assist with other activities appropriate to the success of the course.

Each teacher using the unit is asked to complete and return the evaluation questionnaire found in the appendix. These ratings and suggestions will be used to improve this unit as well as others developed in the future.

Our best wishes for a successful adult program.

Martha A. Butler

John W. Dickens

DISCLAIMER

While attempts were made to provide up-to-date scientific information from a variety of sources of information, the recommendations in technical agricultural practices and products are changing. Pesticides mentioned are for examples only and the user must assume the responsibility for following label directions for each product. If in doubt, contact the proper Agency in your state for a current recommendation.

OBJECTIVES OF THE COURSE

Major Objective: To develop the ability of homeowners to maintain and care for an established lawn.

Lesson Objectives: To develop the ability of homeowners to:

1. Perform the cultural practices required by an established lawn.

Upon completion of Lesson 1, the class member should be able to:

- a. Discuss the importance of a good lawn
- b. Interpret the turf care calendar
- c. Mow the lawn
- d. Water the lawn
- e. Spray for weed control
- f. Spray for insect control
- g. Control lawn diseases

Can do	Cannot do

2. Fertilize and lime an established lawn.

Upon completion of Lesson 2, the class member should be able to:

- a. Take a soil sample
- b. Send soil sample and receive results
- c. Describe fertilizer analysis and ratio
- d. Select a lawn fertilizer
- e. Apply fertilizer at recommended rate, using either complete or nitrogen, phosphorus, and potassium sources
- f. Apply lime at recommended rate

3. Identify and correct the problems found in an established lawn.

Upon completion of Lesson 3, the class member should be able to:

(These three objectives apply to the problems associated with animals, moss, shade, soil compaction, waterlogged soils, and thatch.)

- a. Recognize symptoms of problems associated with a common lawn problem
- b. Describe the cause(s) for a common lawn problem
- c. Implement a solution or cure for the common lawn problem

- | Can
do | Cannot
do |
|--|--------------|
| 4. Identify the need for and renovate an established lawn. | |
| Upon completion of Lesson 4, the class member should be able to: | |
| a. Describe when a lawn needs renovation | |
| b. Follow the steps involved in renovating a lawn, including: | |
| aa. remove weeds | |
| bb. remove thatch and dead vegetation | |
| cc. cultivate the soil | |
| dd. conduct a soil test | |
| ee. apply fertilizer or lime | |
| ff. plant seed | |
| gg. roll the seedbed | |
| hh. irrigate the seedbed | |
4. Identify the need for and renovate an established lawn.

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- dd. conduct a soil test
- ee. apply fertilizer or lime
- ff. plant seed
- gg. roll the seedbed
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Lesson 1

CONDUCTING CULTURAL PRACTICES FOR AN ESTABLISHED LAWN

Objective: To develop the ability of homeowners to perform the cultural practices required by an established lawn.

Problem and Analysis: How should we perform the cultural practices required by an established lawn?

- Importance of a good lawn
- Schedule for turf care
- Mowing
- Watering
- Spraying for weed control
- Spraying for insect control
- Controlling lawn diseases
- Fertilizing and liming

Content

I. Importance of a good lawn

- A. The lawn is perhaps the most important landscape feature of the home ground. It is the garden room carpet -- the canvas of the picture painted for the public side of the home.
- B. Even the most attractive plants will not give the best appearance on a rough, uneven, poorly-sodded lawn. By the same token, weedy, inferior lawns take just as long to mow as lush, well-tended lawns, and weedy lawns usually have to be mowed more often to look their best.
- C. While most lawns are designed principally to serve a decorative function, a good lawn has the following properties.
 1. Holds the soil, and thus, reduces erosion and leaching
 2. Reduces dust, loose soil, and mud that is carried indoors
 3. Provides a cooler setting for the home by reducing glare and reflected heat from the sun
 4. Provides a protective cover for family recreation

II. Schedule for turf care

- A. The turf care calendar below gives the appropriate scheduling of cultural practices as established by the Cooperative Extension Service. Each management topic is detailed in an extension publication listed in the "References" section of this unit. A complete copy of the turf care calendar is included as Master 118-1-1.*

*118-1-1 is Adult Unit 118 -- Lesson 1 -- Master 1.

TURF CARE CALENDAR FOR KENTUCKY BLUEGRASS AND FESCUE LAWNS

A. J. Powell, Jr.

Management	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Comments
Fertilization													Avoid heavy spring and summer fertilization
Liming													Apply anytime according to soil test
Mowing													Mow at 2 1/2 inches
Watering													As necessary - water deeply
Dethatching													Needed when thatch is more than 1/2-3/4" thick
Weed Control													Control broadleaf weeds
													Crabgrass preemergence control
													Crabgrass postemergence control
Insect Control													Sod webworm and white grub control
Disease Control													Control directed against specific disease
Establishment													
Seeding													Seed only after soil preparation
Sodding													Can obtain quick establishment and aesthetics

Source: Turf Care Calendar for Kentucky Bluegrass and Fescue Lawns, AGR-55, University of Kentucky Cooperative Extension Service.

III. Mowing

- The most serious mistakes are mowing lawns too closely, too infrequently, and using a dull mower.
- Height of Mowing: Check blade height and use the following guides for these common grass types:

Grass	Mowing Height
Kentucky Bluegrass	2-2½ inches
Tall Fescue	2-3 inches
Creeping Red Fescue	2-2½ inches
Bermudagrass	½-1 inch
Zoysiagrass	¾-1 inch

Below optimum mowing heights greatly restrict root development, and the grasses become very susceptible to diseases, heat and drought damage, traffic injury, and weed infestation. Newly seeded lawns should be mowed for the first time when the grass becomes 3 to 4 inches tall. For the first mowing, the mower should be set to mow 3 inches high. Subsequent mowings should be gradually lower until the recommended mowing height is reached.

- C. Mowing Frequency: When and how often the lawn is mowed is just as important as selecting the right cutting height. The general rule to follow is: mow often enough so that no more than 1/3 to 1/2 of the sod leafage is removed at any one mowing. If the grass grows too tall, raise the mowing height and do not cut it all off at one time. Removal of more than the recommended leafage at one mowing frequently results in severe shock to the plant and partial or complete loss of the root system.
 - 1. Scalping is the brown, stubbly appearance that results when too much leaf is taken off at one mowing. The long-term effects on a lawn are detrimental, and it should be avoided.
- D. Mowing Pattern: Although not as critical as height of mowing and mowing frequency, the mowing pattern should be considered. In successive mowings, the pattern should be varied in 2 or 3 directions. This will distribute traffic and wear more uniformly over the turf area and improve the quality of the cut. A side-by-side mowing pattern is acceptable, especially if the 360° turns can be made on sidewalks or roadways as opposed to the edge of the turf. A circular cut starting at the perimeter and working toward the center of the lawn is best if the turf is thinning due to about-face turns.
- E. Removal of Clippings: Clippings are not harmful if they are evenly spread by the mower and are not so thick that they shade the grass below. Short clippings decay quite rapidly and do not cause a thatch problem. They provide organic matter to the soil; recycle plant nutrients (particularly nitrogen, phosphorus, and potassium); and help water move into the soil. The proper mowing height and frequency will leave short clippings, and thus, the problem of removal can be avoided.

IV. Watering

- A. Once a lawn is established, it will only need to be watered during excessively dry periods. Several factors should be considered before deciding whether to water or not. Among these factors are the availability and cost for irrigation water.
- B. When to Water: An easily detected symptom of a dry lawn is "foot-printing." After walking across the lawn, note how long it takes for the grass leaves to return to their upright position. If the lawn has been receiving adequate moisture, the footprints will be hardly noticeable. If it has not, the leaves will be slow to stand up, and the footprint will be evident.

- C. Time of Day to Water: Morning watering (preferably just after sunrise) is the best for minimizing disease problems. Water will evaporate quickly at this time of day and will help prevent diseases caused by grass remaining wet. Avoid late afternoon and evening watering.
- D. Watering Frequency: Bluegrass and fescue are seldom killed by drought. They will lose their green color and turn brown during a prolonged hot, dry spell, but will resume growth and regain color when the rains come. Lawns actually use one-half to two inches of water per week. Lawns maintained at high cutting levels with high fertility levels on coarse-textured soils generally use more water and require more frequent watering. Generally, the most frequent watering will be in midsummer.
- E. Amount of Water: Thorough watering is required to benefit the root zone of the lawn. The soil should be moist for the top 4 to 6 inches which requires 1/2 to 1 inch of rainfall or irrigation. A soil probe or knife can be used to determine how deep the soil is moist or empty cans may be placed on the lawn in two or three locations to determine the amount of water actually delivered on the lawn. Avoid overwatering the lawn as a waterlogged lawn is prone to soil compaction and disease. Frequent shallow watering should be avoided because it causes shallow rooting and encourages crabgrass and disease invasion.
- F. Methods of Application: The two major watering systems are overhead sprinklers and surface flooding. Sprinkler irrigation is most common with the main components being the sprinkler head(s), water distribution line(s), and pump or other pressure source. Home lawn watering usually involves a portable hose with a single sprinkler attached. Proper timing in moving the sprinkler across the lawn is required for effective irrigation to avoid excessive water application.
- V. Spraying for Weed Control
- A. How Weeds Get in a Lawn:
1. Weed seeds are frequently in the soil when the lawn is seeded. Seeds may live dormant in the soil and germinate to become a major weed problem.
 2. Sod for lawns is often taken from old pastures and fields which have a heavy infestation of weeds.
 3. Weed seeds are carried into lawns by sowing impure seed, wind, water, mowers, birds, pets, or by people.
- B. Weed Prevention: A dense, competitive turf is the best prevention of weed invasion. Such a turfgrass can be established by the following:*
1. Select adapted turfgrass species

*Adapted from p. 67 of How to Have a Beautiful Lawn.

2. Avoid close and/or frequent mowing
3. Keep soil pH between 6 and 7
4. Maintain adequate nutrient levels, especially nitrogen
5. Avoid excessive watering
6. Cultivate compacted soils by coring or slicing
7. Minimize the damaging effects of disease, insect, or nematode attacks
8. Renovate poor lawns in the fall to benefit from the fall rains and cool nights

C. Weed Identification: Before weeds can be controlled, they must be correctly identified. A useful filmstrip, Lawn Weeds -- Identification and Control, is available from Vocational Agriculture Service and is listed in the Unit References. The county Cooperative Extension Service Office could also be contacted for aid in identifying problem weeds.

Common Lawn Weeds, AGR-12, from the Kentucky Cooperative Extension Service has drawings of many common weeds.

D. Weed Control: Some weeds persist and grow even in a well-established, properly managed turf. Weeds should be controlled prior to flowering, when temperature and moisture favor grass growth, or when conditions least favor germination and emergence.

1. Physical Control: Routine mowing may control many of the larger, more erect growing weeds. Mowing should be timed during seedhead formation to reduce weed problems. Hand pulling can be effective for annual broadleaf weeds in a small area or near ornamental plants that may be harmed by herbicides. A hand sod cutter can be used to remove creeping weeds such as bentgrass in Kentucky bluegrass. The contaminated piece should be lifted with all lateral stems, and the area repaired by spot seeding or sodding. A spud (v-shaped piece of metal) may also be used to remove weeds.
2. Chemical Control: For long-term weed control, chemicals are commonly used on large areas of turf. It is the only effective way to control some creeping perennial weeds.

- a. Nonselective herbicides are used to kill all plants within the target application area. These types of herbicides may kill the weed by contact or systemic means. Paraquat, for example, kills by contact action without any translocation of the herbicide. All the living tissue contacted will be killed and will show signs of death within 1 or 2 days of application. Nonselective herbicides with systemic activity include glyphosate and dalapon. The chemical is absorbed and translocated throughout the plant including in the underground rhizomes and rootstalks where kill occurs. This type of herbicide is used mainly for the control of perennial weedy grasses where no selective herbicide is available.

- b. Selective herbicides are designed to control weeds without damaging the turfgrass plants. Examples include: benefin; bensulide; 2,4-D (which can damage bentgrass, dichondra, and certain St. Augustinegrass varieties); DCPA; DSMA; and MSMA. Most of the selective herbicides have systemic activity. Selective, systemic herbicides must be applied at the specific rate recommended since absorption and translocation throughout the plant are most important in attaining effectiveness. If an excessive rate of application is used, the leaf tissue may be killed, translocation impaired, and underground weed parts may not be killed. Visual symptoms of weed kill may not appear for 5 to 15 days after application.
- c. Preemergence herbicides are applied before weeds germinate and emerge. They are most commonly used on turfs to control annual grasses. Examples of preemergence herbicide include: benefin, bensulide, DCPA, and siduron. These chemicals will be effective in the soil root zone for 4 to 10 months before they degrade.
- d. Postemergence herbicides are applied after the target weed emerges through the soil. Examples include: 2,4-D, dicamba, mecoprop, DSMA, and MSMA. These chemicals are commonly used to control broadleaf weeds and annual weedy grasses. Most postemergence herbicides have a short period of toxic activity and rapidly degrade within 1 to 4 weeks after application.
- e. Timing of herbicide application: Generally, herbicides are most effectively used on actively growing weeds. The best time of day to apply is just after dawn or just before sunset. Wind activity is usually at its minimum point then, and this will help prevent the drifting of herbicide mists and vapors onto nearby vegetable or ornamental plants. The best time of the year for control can be determined from current weed control recommendations from the Extension Office.
- f. Herbicide handling: All herbicides should be applied according to the directions on the manufacturer's label. Valuable information on the label includes the: (a) trade name and chemical name, (b) amount of active ingredient(s), (c) directions for use, (d) weeds which the product will control, (e) toxicity and hazards to the user, and (f) the antidote in case of accidental exposure. Some safeguards to insure proper handling and application include:
 1. Purchase a non-restricted chemical for which the average homeowner need not be a certified applicator.
 2. Do not apply herbicide at a higher rate than is recommended or you may injure the turf.
 3. Be sure the sprayer or spreader is in proper operating condition and is properly calibrated according to the application rate specified on the label.

4. Apply the herbicide only to the target weeds at a time when drift can be avoided.
 5. Wear proper protective clothing, such as long sleeves and pants, gloves and boots, hat, goggles, and respirators, during application of herbicides.
 6. All herbicides should be stored in a locked, ventilated cabinet in their original containers. This will help to ensure that only the proper chemical is applied.
 7. The herbicide handler should avoid repeated or prolonged skin exposure and should not inhale the dust, mist or vapors. They should always wear gloves when handling any pesticide and should thoroughly wash equipment, clothes, and the body immediately after treatment.
 8. Follow manufacturer's label directions in disposing of excess pesticides and empty containers.
- g. Herbicide Recommendations: The current "Weed Control Recommendation for Kentucky Bluegrass and Tall Fescue Lawns and Recreational Turf," AGR-78, published annually by the Cooperative Extension Service should be obtained and used here for the most recent recommendations. A copy for each person would be helpful for his or her own use in lawn care.

VI. Spraying for Insect Control

- A. Identifying Insect Problems: Generally, a few insects in a turf are not a problem, but becomes one when a specific insect is present in concentrated populations. The symptoms of insect damage may be confused with damage caused by such conditions as drought, heat, diseases, nematodes, or nutrient deficiencies. To determine if a turf problem is caused by insects, examination of both the shoots and roots is necessary. Specific damage symptoms and the presence of actively feeding insects should be noted for a correct diagnosis. The county extension service or a reputable local nurseryman can confirm the insect problem if there is any question.
- B. Insect Prevention: The following can aid in the prevention of some insect problems -
1. Good sanitary practices
 2. Preplant insect control
 3. Resistant turfgrass varieties

Insect introduction can be avoided in healthy areas by avoiding the use of contaminated sods, sprigs, plugs, soil, and equipment. Contaminated soil and equipment can be fumigated or heat treated while contaminated vegetative material can be sprayed with an appropriate insecticide to prevent insect problems. Preplant insect control includes the use of fumigants such as metham or methyl bromide on turf sites with serious insect problems. Insect-resistant

turfgrass varieties are recommended, but there are only a limited number of those available. Good turfgrass management in terms of mowing, fertility, and irrigation will help a turf survive insect attacks and recover quickly.

- C. Chemical Control: Insecticides should only be used to control a serious insect problem. The insect involved must be positively identified in terms of type, feeding habit, and life style to determine the type and time of insecticide application. Insecticides should always be handled according to the manufacturer's directions on the label. They can be applied in granular form with a fertilizer spreader or in liquid concentrates or wettable powders with a sprayer. The spreader or sprayer must be accurately calibrated for the specified application rate to ensure proper insect control. The chemical application should be applied only to the turf area requiring insect control and should be watered in immediately when controlling soil insects. The turf should be allowed to dry before humans and animals are allowed on it. Proper safety procedures in storage, handling, and application of insecticides should be followed since some can cause serious injury. All equipment used in chemical application should be cleaned thoroughly after use.
- D. Insecticide Recommendations: A current copy of an extension publication in insecticide use and recommendations should be obtained and used as the most up-to-date source. A chart from the USDA publication, Lawn Insects: How to Control Them, Home and Garden Bulletin Number 53, is included to show the chemicals to use for specific insect problems. A copy of current recommendations for each person would be helpful for his or her own use in lawn care.

LAWN PESTS AND INSECTICIDES TO USE IN THEIR CONTROL¹

Lawn Pest	Diazinon (Spectracide)	Carbaryl (Sevin)	Chloro- pyrifos (Dursban)	Trichlo- rofon (Dylox)
Ants ²	X	X	X	
Armyworms	X	X	X	X
Billbugs	X	X		
Chiggers	X		X	
Chinch bugs	X	X	X	
Cicada killer wasps	X			
Cutworms	X	X	X	X
Earwigs	X	X	X	
Fleas	X	X	X	
Frit fly	X			
Grasshopper			X	
Grubs ⁴	X		X	X
Leafhopper	X	X		
Millipeds	X	X		
Mites, clover	X		X	
Sod Webworm	X	X	X	X
Ticks	X		X	

¹ Several insects are not listed either because no control measures are necessary or chemicals for their control are not registered at this time.

² If only a few ant nests are present, treat them individually. Wash the insecticide into the nests or drench the mounds with it. Special treatment is required to control fire and harvester ants; consult your State Agricultural Experiment Station for latest recommendations.

³ To control cutworms, apply the insecticide in late afternoon.

⁴ In hot, dry areas, lower dosages may be necessary to prevent burning the grass; consult your State Agricultural Experiment Station.

Source: "Lawn Insects: How to Control Them," USDA, Home and Garden Bulletin Number 53, Revised July 1980.

VII. Controlling Lawn Disease

- A. Identifying Disease Problems: Specific symptoms can be associated with each disease and may be seen on the shoot and/or root plant parts. The parts should be examined thoroughly for disease symptoms and/or characteristic fungal structures. Particular attention should be given to the outer, advancing edge of the diseased area. Also to be considered during the identification process are the specific turfgrass species, environment, and maintenance.

- B. Disease Prevention: Many common disease problems can be minimized or eliminated by the use of good sanitary practices. Sod should be examined and disease-free before placement in a healthy area. Sod and vegetative plant material should only be purchased from a reputable grower to prevent disease contamination. All disease-infested equipment should be heat treated and all soil fumigated with metham or methyl bromide before using on a new site. Selection of disease resistant turfgrass varieties or blends is the best guard against many serious diseases. Several cultural practices to minimize disease development are given on page 76 of How to Have a Beautiful Lawn.
- C. Chemical Control: Herbicide and insecticide use is more common on lawns than fungicide use which is prevalent on greens and sport turfs. Two approaches exist for the use of fungicides. Curative disease control involves fungicide application only when a disease problem exists and is most common with home lawns. Preventive disease control involves the application of a fungicide to prevent infection. This approach is more expensive and is used mainly for intensely maintained turfs. There are two types of control as related to fungicides.
1. Nonsystemic fungicides control lawn diseases by killing the parts on the surface of the host. This type kills only the fungal parts contacted and is only effective for a few days because of the removal by mowing or water.
 2. Systemic fungicides are effective much longer than nonsystemics because they are absorbed and translocated throughout the plant. They work by killing the fungus within the host plant. In a preventive disease program, it is best to alternate between systemic and nonsystemic fungicides to minimize the development of resistant fungal strains.
- The appropriate fungicide can be selected once the disease is identified. All fungicides must be applied according to the manufacturer's directions on the label. The specified rate of application should be strictly followed to avoid chemical injury to the turf. Fungicides can be applied in spray or granular form with a correctly calibrated sprayer or spreader. A wettable powder is most commonly used when spraying. Application should only be made to the turf requiring disease control. Most fungicides should be watered into the root zone immediately afterwards. Care should always be exercised in handling fungicides, and all clothing and equipment should be thoroughly washed immediately following treatment.
- D. Fungicide Recommendations: A current copy of the annual Kentucky Cooperative Extension publication, "Chemical Control of Turfgrass Diseases," numbered PPA-1, should be obtained to give the most up-to-date fungicide recommendations. A copy for each person would be helpful for his or her own use.

VIII. Fertilizing and Liming

- A. Importance: A regular schedule for the application of fertilizer and lime is a very important cultural practice. This application will improve the density, color, and recuperative potential of the turfgrass. A healthy, properly fertilized and limed home lawn will withstand temperature and climate extremes better. It will also aid the turfgrass in surviving attacks by diseases, weeds, and insects. Due to the extreme importance of fertilizing and liming, an entire lesson on the subject has been developed to incorporate all the available information.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the Teacher:

1. A person can go to a lot of time and expense to build a nice-looking home and establish shrubs and trees, but if unsuccessful in attempts to have a beautiful lawn, the result will be noticeable to all.
2. The homeowner does not have to be an expert to grow a good lawn but there are sound establishment and maintenance practices to be followed. The practices are related to mowing, watering, controlling pests and diseases, and fertilizing and liming.
3. Calculate the number of hours each person spends working on their lawn and multiply by a suitable dollar-per-hour labor figure.

B. Things to be brought out by class members:

1. Have members think of the homes that they have seen and consider to be beautiful. Identify the factors which make these homes beautiful. A well-kept lawn will, no doubt, be one of these factors.
2. Members share personal experiences with different lawn grasses.
3. Also, members share experiences in other areas, such as:
 - a. fertilizing
 - b. mowing at different heights
 - c. weed control
 - d. disease and insect problems

II. Enrichment Activities

- A. Arrange for field trips in order to examine established lawns that exhibit excellent or poor maintenance practices.
- B. Contact a resource person to assist the class with a specific cultural practice.
- C. Perform cultural practices on a class member's lawn or on the school lawn.

III. Suggested Teaching Materials

A. References and Audiovisuals (Refer to Appendix A)

B. Masters

- Turf Care Calendar for Kentucky Bluegrass and Fescue Lawns
- Correct Mower Height

C. Resource Personnel

1. Extension specialists
2. Local sources (e.g., agronomist)
3. Groundskeeper from a golf course or park

TURF CARE CALENDAR FOR KENTUCKY BLUEGRASS AND FESCUE LAWNS

AGR-55

A. J. Powell, Jr.

Additional
Extension
Publications

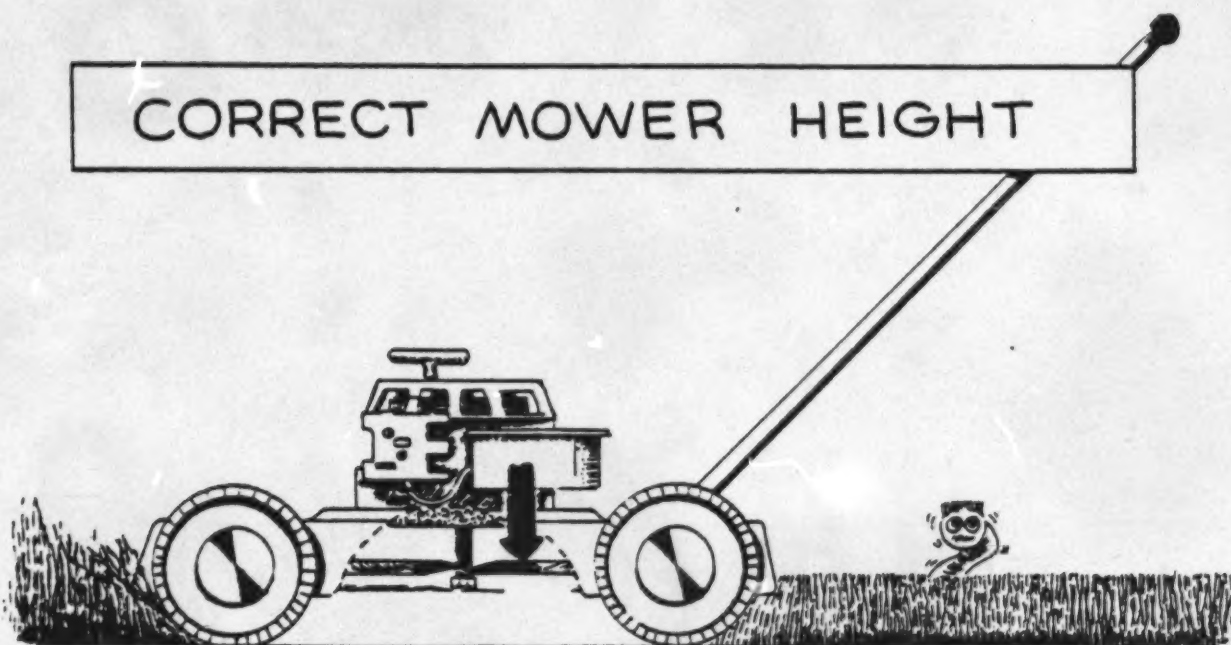
Management	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Comments	Additional Extension Publications
Fertilization	///				///				///	///			Avoid heavy spring and summer fertilization	AGR-53
Liming	///	///	///	///	///	///	///	///	///	///	///	///	Apply anytime according to soil test	AGR-16
Mowing			///	///	///	///	///	///	///	///	///	///	Mow at 2 1/2 inches	AGR-54
Watering					///	///	///	///	///				As necessary - water deeply	AGR-54
Dethatching			///	///					///				Needed when thatch is more than 1/2-3/4" thick	AGR-54
Weed Control			///	///					///	///			Control broadleaf weeds	AGR-21
		///	///										Crabgrass preemergence control	AGR-21
						///	///						Crabgrass postemergence control	AGR-21
Insect Control						///	///	///	///				Sod webworm and white grub control	ENT-7 & 10
Disease Control			///	///	///	///	///	///	///	///	///	///	Control directed against specific disease	PPA-1
Establishment														
Seeding		///						///					Seed only after soil preparation	AGR-50 & 51
Sodding		///	///	///	///	///	///	///	///	///	///	///	Can obtain quick establishment and aesthetics	AGR-7

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE . COOPERATIVE EXTENSION SERVICE
agriculture . home economics . 4-H . development

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. Charles E. Barnhart, Director of Cooperative Extension Service, University of Kentucky College of Agriculture.

Issued 8-76, 5M; 3-77, 5M; 7-78, 5M



MOW LAWN TO MAINTAIN A $2\frac{1}{2}$ " HEIGHT (Average)

MOWING HEIGHT *for* LAWN GRASSES

SPECIES	DESIRABLE HEIGHT
KENTUCKY . BLUEGRASS	2- $2\frac{1}{2}$
CREEPING (Red) FESCUES	2- $2\frac{1}{2}$
ZOYSIAGRASS	$\frac{3}{4}$ - 1
BERMUDAGRASS	$\frac{1}{2}$ - 1
TALL FESCUE	2 - 3
REDTOP (Temporary)	3
RYEGRASS (Temporary)	3
	INCHES

Revised from Adult 110-6-6
118-1-2

Lesson 2

FERTILIZING AND LIMING AN ESTABLISHED LAWN

Objective: To develop the ability of homeowners to fertilize and lime an established lawn.

Problem and Analysis: How should we fertilize and lime an established lawn?

- Soil testing
- Fertilizer facts
- Fertilizer selection
- Timing of application
- Application rate
- Fertilizer application
- Liming

Contest

I. Soil Testing

- A. Introduction: Soil testing is a type of chemical analysis. Combined with past fertilizer management and cropping history, it provides a guideline for the fertilizer needs of soils. A soil testing service is available through a program of the University of Kentucky Agricultural Experiment Station and the Cooperative Extension Service. The small charge for processing covers the cost of handling and laboratory operation, but saves money in terms of applying the exact amount of lime and fertilizer required. Home-test kits are available from garden supply centers. However, be sure to do several tests to ensure reliability of the results.
- B. Timing of Soil Testing: Samples may be taken in fall or spring, but fall samples allow for quicker testing service and better management decisions. From the soil test results and other considerations, the County Extension Agent for Agriculture will make recommendations based on guidelines in AGR-1, "Lime and Fertilizer Recommendations."
- C. Taking the Sample: (Gardening and Groundskeeping Module GG-1, "Taking Soil Samples," could be consulted for complete information.) The tools required for taking a soil sample include a soil probe, an auger, or spade and a knife for taking the individual cores. A clean bucket, preferably plastic, is needed to collect and to mix the cores. Boxes and information forms for submitting the samples are all available at the County Extension Office. For nontilled areas where fertilizer remains on the soil surface or is incorporated only in the immediate surface (like lawns and pastures), samples only need to be taken to a depth of 4 inches. Soil cores should be selected in a random manner from at least 10 sites. A very large lawn or one with obvious differences in the

terrain may require more than one soil sample to make valid recommendations. Fence rows and garden sites should be avoided for core samples.

- D. Preparing the Sample: The samples in each core should be mixed together and allowed to air dry. The sample should not be dried in an oven or at an abnormally high temperature. When the soil is dry, 1/2 to 1 pint of soil should be placed in the sample box. The information section on the box and on the form need to be completed with the proper information. The sample and information should be taken to the County Extension Office.
- E. Lime and Fertilizer Recommendations: The test results and recommendations will be returned thru the County Extension Agent when the testing is completed. The recommendation will give the amounts of agricultural lime and of each of the three major elements in fertilizer required in pounds per 1000 square feet. The amount of fertilizer required to provide these major elements must be considered separately and will be discussed in the "Fertilizer Facts" section. Records should be kept showing when and how much lime and fertilizer were applied to the lawn.

II. Fertilizer Facts

- A. Fertilizer Analysis: Each state has its own laws regarding fertilizer labeling, but all fertilizer labels must carry the specific analysis. The analysis tells the weight percentage of the three major nutrients (also called macro-nutrients):

1. Total nitrogen (N)
2. Available phosphoric acid (P_2O_5)
3. Water soluble potash (K_2O)

A fifty pound bag of fertilizer with a 16-4-8 analysis would be calculated in the following way to determine the weights of the major nutrients:

$$\begin{array}{l}
 16\% \text{ N} \\
 .16 \times 50 \text{ lbs.} = 8 \text{ lbs. nitrogen} \\
 4\% \text{ P}_2\text{O}_5 \\
 .04 \times 50 \text{ lbs.} = 2 \text{ lbs phosphoric acid} \\
 8\% \text{ K}_2\text{O} \\
 .08 \times 50 \text{ lbs.} = 4 \text{ lbs. potash}
 \end{array}$$

A total of 14 pounds of plant food is available in the 50 pound bag of fertilizer. The remaining weight is made up by the carriers of the nutrients plus filler materials such as lime or sand to bring the total to a convenient weight. Fertilizers may also contain sulfur, calcium, iron, and magnesium, which may or may not be indicated on the label. The analysis is important in fertilizer purchases in order to

determine the cost per pound of plant food rather than the cost per pound of fertilizer.

- B. Fertilizer Ratio: The ratio of a fertilizer indicates the proportion of nitrogen, phosphoric acid, and potash. A 16-4-8 fertilizer has the ratio of four parts nitrogen to one part phosphoric acid to two parts potash. The fertilizer ratio is dependent of the soil nutrient level. When establishing a lawn, a 1-1-1 ratio is widely used by the application of a 10-10-10, 15-15-15, or 20-20-20 fertilizer. Established lawns usually respond better to a 4-1-2 or a 5-1-2 ratio such as 16-4-8 and 25-5-10 fertilizer respectively.

III. Fertilizer Selection

- A. Introduction: Commercial fertilizers vary considerably in their chemical and physical characteristics. Many factors need to be considered to match the proper fertilizer with the given soil conditions and lawn site. Each of these factors will be discussed below.
- B. Physical Characteristics: Fertilizer particles of the same size will achieve a uniform distribution over the lawn area. This is especially true with a centrifugal-type fertilizer spreader. Granulated and/or screened fertilizers are more expensive, but also give a more uniform distribution. Screened fertilizers also have the advantage of only minimal dust problems during application. Care should be given to make sure stored fertilizer does not attract moisture which can cause caking.
- C. Chemical Characteristics: Water soluble fertilizers (ammonium nitrate, ammonium sulfate, urea, potassium chloride, and potassium sulfate) will cause foliar burn if left on the leaf surface for a period of time. This can be minimized by washing the fertilizer into the soil immediately after application or by selecting a fertilizer that resists foliar burn. Generally, water soluble fertilizers have a higher potential for foliar burn than slow release fertilizers. By selecting a fertilizer with a strong acidifying effect like ammonium sulfate, it is possible to reduce the soil pH. This is desirable for alkaline soils or where irrigation water contains significant amounts of calcium and magnesium. Care must be exercised not to develop an excessively acidic soil through continual use of such fertilizers.
- D. Cost: Before selecting a fertilizer ratio, a soil test should be done to determine the available nutrients in the soil. Cost should be calculated on the amount of available plant nutrients in the fertilizer, rather than the total weight. However, other factors may be more important than total cost to an individual.
- E. Release Rate: Fertilizers with a high degree of water solubility have a short initial release time. Thus, the period between application and

visual turfgrass response can be as short as two to four days. Natural organic fertilizers may not be quick to respond due to a slow release rate, which is dependent on soil temperature. Thus, to obtain early spring growth, a fertilizer with carriers containing at least fifty percent of nitrogen in water soluble form is preferred.

Response time is also dependent on the duration of nutrient release over an extended period. The longer the residual response time, the less often fertilizer application will have to be made. Water soluble fertilizers release for about four to six weeks while eight to twelve week response times have been reported for some slow release fertilizers. For sandy and/or irrigated soils which are prone to nutrient loss from leaching, slow release fertilizers should be given strong consideration.

- F. Types of Fertilizers: Lawns are generally fertilized at least once a year with a complete fertilizer containing nitrogen, phosphorus, and potassium. Additional fertilizer containing only one of the major nutrients may be applied during the year. These single nutrient fertilizers are often referred to as nitrogen, phosphorus, or potassium carriers.

IV. Time of Application

- A. The timing of fertilizer applications is dependent on the following: the particular turfgrass/species, lawn quality, and release rate of the selected fertilizer. The color of the grass and the rate of growth can be used as guides for the appropriate fertilizer program. Generally, the yearly amount of fertilizer can be divided into 3 or 4 applications with the major portion of the fertilizer applied in the fall. A split application—one in early fall and one 4 to 6 weeks later—will aid in avoiding excessive growth and will prolong green color in the fall. In the spring, enough fertilizer should be applied to keep the grass growing vigorously but not to the point of overstimulation. This light application in the spring will prevent a lush growth of grass, reduce disease, and will lessen the amount of mowing. Organic or urea-form nitrogen fertilizer will aid by providing a more continuous supply of nitrogen.
- B. The following guidelines have been set for fertilization timing:*
1. Nitrogen should be avoided or applied with care during heat stress.
 2. Summer nitrogen applications or unirrigated turfs should be avoided during extended droughts.
 3. Nitrogen should be avoided 30-40 days prior to winter dormancy especially in areas prone to winter kill.
 4. Apply nitrogen immediately after any practice which temporarily disrupts the lawn density such as vertical mowing, coring or slicing.
 5. Nitrogen fertilization should be avoided during the growth periods of lawn diseases.
 6. Apply fertilizer immediately after serious disease, insect, or nematode attacks if temperature and moisture conditions are favorable.

*SOURCE: Paraphrased from Fertilization Timing Guidelines, p. 58, How to Have a Beautiful Lawn.

7. Avoid fertilization during periods of slack turfgrass growth when conditions are favorable for weed growth.
8. During midsummer when lawns are subjected to intense traffic and wear, potassium fertilizations at three to four week intervals would be beneficial.

V. Application Rate

- A. Nitrogen: Nitrogen fertilizer should not be applied at the same time for all grasses. Fall and winter nitrogen fertilization is best for Fescues and Kentucky Bluegrass since they grow best in cool weather. These grasses do not need spring and early summer fertilization for the normally fast growth of other grasses, but may require light fertilization after heavy spring rains. Over-fertilization at this point will encourage the growth of weeds such as crabgrass. Bermuda-grass and Zoysiagrass, which are grown mainly in Western Kentucky, grow best during hot weather. They need late spring and summer fertilization. The following charts indicate appropriate fertilization for these two categories of lawn grasses--

FERTILIZER PROGRAMS FOR KENTUCKY BLUEGRASS AND FESCUE

Time to Apply	Actual Nitrogen (N) Needed per 1000 sq. ft. of lawn	Suggested Fertilizer per 1000 sq. ft. of lawn	
September	1 lb.	8 lb. 5 lb.	12-4-8 20-10-10
October - Mid November	1-1 1/2 lb.	8-12 lb. 5- 7 lb.	12-4-8 20-10-10
Mid November- January *	1-1 1/2 lb.	8-12 lb. 5- 7 lb.	12-4-8 20-10-10
Mid May- Mid June	0-1/2 lb.	4 lb. 2 1/2 lb.	12-4-8 20-10-10

*If inadequate fertilizer was applied in late fall, 1/2 to 3/4 lb. of actual nitrogen per 1000 ft. 2 may be applied in early spring if turf color and growth indicate a need.

FERTILIZER PROGRAMS FOR BERMUDAGRASS AND ZOYSIAGRASS

Time to Apply	Actual Nitrogen (N) Needed per 1000 sq. ft. of lawn	Suggested Fertilizer per 1000 sq. ft. of lawn	
March-April	1-1 1/2 lb.	8-12 lb. 5- 7 lb.	12-4-8 20-10-10
May-June	1-1 1/2 lb.	8-12 lb. 5- 7 lb.	12-4-8 20-10-10
July - Mid August	1-1 1/2 lb.	8-12 lb. 5- 7 lb.	12-4-8 20-10-10

- B. Phosphorus and Potassium: Phosphate and potash are commonly applied along with the nitrogen in a complete fertilizer. Based on soil test results, phosphate and potash should be applied according to the following:

<u>Soil test level</u>	<u>lbs. per 1000 sq. ft.</u>	
	<u>P₂O₅</u>	<u>K₂O</u>
High (above 60P, 250K)	0-1	0-1
Medium (60-30P, 250-165K)	1-2	1-2
Low (below 30P, 165K)	3-5	3-5

Specialty fertilizers containing only P or K may be used to clear up a deficiency in either of the nutrients.

VI. Fertilizer Application

- A. Fertilizer can be applied either in a dry form or a water carrier. Whatever method is used, uniform fertilizer distribution is most important. The correct spreader should be selected to apply the proper type of fertilizer and should also be in proper operating condition. The applicator should be thoroughly washed after application to minimize corrosion and to keep the equipment in proper working condition. The individual operating the spreader is the most important factor in uniform fertilizer application. Improperly applied fertilizer will leave streaks or spots of light and dark grass or possibly burn the grass where water soluble fertilizers have overlapped. Care should be taken to fertilize only the target lawn area and to avoid application to walks, driveways, and roads. Fertilizer in these areas may wash off into the sewer and contribute to water pollution. Hand application of a dry fertilizer should be avoided because it is not uniform and may cause burning.
- B. Application Types: The two types of application for fertilizers are expanded upon below:
1. Dry Spreaders are used to apply dry fertilizers and fall into two categories -- broadcast centrifugal or gravity (trough) spreaders. The advantage of a centrifugal spreader is that it covers a wider area more quickly with less overlapping or missed areas than gravity spreaders. Centrifugal spreaders may not apply fertilizer evenly, and thus, the outer edge will probably receive less fertilizer.

The gravity-type spreader is especially effective where fertilizer may be displaced by wind or on a small lawn to avoid application of fertilizer to walks and roads. When using this type of spreader, the application widths should meet without any overlapping or missing. Foliar burn can be caused by overlapping with a water soluble carrier.

A good way to ensure uniform distribution of dry fertilizers is to divide the fertilizer into two equal portions. Half the fertilizer should be applied in one direction and the second half applied over the same area in a crosswise direction. The fertilizer should be lightly watered in immediately after application to remove the salt particles from the leaves. This will help prevent foliar burn.

2. Liquid Application of a fertilizer in a water carrier serves as a foliar feeding or a soil drench. Foliar feeding involves the application of some nutrients to the lawn so they are absorbed directly into the leaves. Only a small amount of nutrients is applied to prevent foliar burn-usually a maximum of a half gallon of water per 1000 square feet. Because of the small amounts of nutrients applied, foliar feedings are usually practiced as frequently as every one or two weeks. This type of fertilization can correct micronutrient deficiencies such as iron.

Soil drench is a method of liquid fertilization often used by lawn care services. The nutrients applied from the soil drench method are absorbed thru the root system from the soil - the same as with dry applicators. Because of this, a much larger amount of water is used than with foliar feeding to wash the nutrients into the soil. Hose attachments can be used for liquid fertilizing, but they are hard to use to obtain a uniform application. Sufficient time must be spent to achieve uniform application with this method.

VII. Liming

- A. Benefits: A sound liming program is considered the first step in building and maintaining a productive soil for both crops and lawns. The soil pH (or the acidity or alkalinity of a soil) influences the available nutrients to growing plants. For example, harmful amounts of manganese and aluminum are available to plants at a low pH. At a high pH, the amount of available phosphorus is significantly reduced. Soil testing is important to determine when lime needs to be applied. Usually lime is called for when the pH drops below 6. The following is a list of benefits from liming the soil.*

1. Neutralizes soil acidity and reduces the toxic effects of soluble manganese and aluminum which are prevalent at low pH.
2. Supplies calcium and magnesium to plants.
3. Increases availability of most major plant nutrients.
4. Speeds bacteria activity in breaking down organic matter.
5. Increases fixation of atmospheric nitrogen by soil and legume bacteria.
6. Helps improve soil structure.

*SOURCE: Liming Acid Soils, AGR-19, Kentucky Cooperative Extension Service.

- B. Timing: Lime can be applied at any time of the year. Late fall or winter are the best times to lime since it will be correcting soil acidity during the winter months for the growth surge in the spring. Also alternate freezing and thawing will encourage lime movement into the soil. Whenever possible, lime should be applied just before a rain so that the lime is washed off the turfgrass into the soil. Watering the lawn will achieve the same effect. Lime should not be applied within two weeks of a fertilizer application.
- C. Recommendations: The soil test results obtained from the County Extension Agent will give a recommendation for lime based on the soil pH. Approximately 100 pounds of ground limestone per 1000 square feet will raise the pH about one unit. Finely ground limestone should be used to achieve the maximum results and should be broadcast in such a way that it is not carried away by the wind. A gravity spreader is usually most effective for application.

Suggestions for Teaching the Lesson

I. Developing the Situation

- A. Things to be brought out by the teacher:
1. Established lawns must receive regular applications of fertilizer in order to maintain green color and promote new growth.
 2. Acid soils decrease the amount of nutrients available to plants. This acidity can be corrected by applications of lime.
- B. Things to be brought out by class members:
1. Have members relate their experience in applying fertilizer and lime to lawns.
 2. Have members relate costs encountered in fertilizer and lime application and what other factors they considered in addition to total cost.

II. Enrichment Activities

- A. Arrange for field trips in order to visit sites with high or low levels of fertilization.
- B. Perform soil tests on members' lawns to determine fertilizer and/or lime requirements.
- C. Apply fertilizer and/or lime on members' lawns or on the school lawn.

III. Suggested Teaching Materials

- A. References and Audiovisuals (Refer to Appendix A)
- B. Resource Personnel
 1. Extension specialists
 2. Local sources (e.g., commercial applicators)
 3. Garden supply store personnel

Lesson 3

CORRECTING COMMON ESTABLISHED LAWN PROBLEMS

Objective: To develop the ability of homeowners to identify and correct the problems found in an established lawn.

Problem and Analysis: What are the common lawn problems in an established lawn and how should we correct them?

- Animals
- Moss
- Shade
- Soil Compaction
- Waterlogged Soils
- Thatch

Content

I. Animals

- A. Moles: Moles are small burrowing animals that live underground and eat insects. Their tunneling activity, which occurs just below the soil surface, can cause raised soil ridges and mounds at the tunnel entrances. Besides unsightly ridges and mounds, turfgrass roots are severed along the raised ridges and water does not pass to the turfgrass. Trapping and/or controlling insects are often the most effective techniques to eliminate moles. Traps should be moved daily if not successful in a particular location.
- B. Rodents: Many rodents, including gophers, ground squirrels, mice, and voles, can damage turfs by tunneling and burrowing. Ground squirrels smother the turf by pushing large piles of soil at a tunnel entrance. Mice and voles make runways in the turf--often under a winter snow cover. For tunneling animals, fumigation with a lethal gas is most effective while poison baits are also good. Consult with local garden supply store personnel for recommendations in controlling rodents.
- C. Skunks: These night-feeding animals prey on soil insects, especially grubs. They can cause serious damage to a turf by uprooting it. Pets (and humans) may also be sprayed with scent. Irregular-shaped spots where the turf has been dug up, lifted out, or rolled back are indications of damage done by skunks. The best approach, if it becomes a serious problem, is to eliminate the food source by applying an insecticide.
- D. Birds: Birds do not usually create problems in higher cut lawns, but can cause serious problems to closely mowed turfs. A high worm or larvae population will usually result in concentrated bird activity on a turf. Control is best managed by elimination of the food source. Larvae of sod webworms and cutworms are often the food source.

- E. Dogs: Dog urination causes circular to oblong patches of dead turf, usually with a zone of darker green, more rapidly growing grass around the outer edge. The urine usually only kills the leaves, and thus, the turf is capable of recovering from underground buds in two or three weeks of favorable temperature and moisture. The best way to avoid or correct this problem is to keep dogs off the lawn. Fencing the lawn or enforcing lease regulations are two other solutions.

II. Moss

- A. Description: Mosses produce a branched, threadlike growth that forms over the turf like a tangled, green mat. Under favorable conditions, it can grow to a sizeable thickness. Many species of moss infest turfs, and they reproduce by spores carried by the wind and rain.
- B. Cause: Neglected turfs are the most common spot for mosses. Conditions such as poor drainage, improper pH, and soils with poor fertility may lead to the establishment of moss. Mosses can also grow on highly alkaline or droughty soils if other conditions exist. Closely mowed, thatched turfs of mostly nonaggressive species are especially prone to invasion by moss.
- C. Control: Correcting the original cause of development is the first step in controlling moss. This may include cultivating, draining, fertilizing, or thatching soils.

Cultural practices to be changed include raising the cutting height and adjusting the irrigation practices to avoid excessive water. A more vigorous growing turfgrass species or variety that is better adapted to the particular soil and environmental conditions will reduce moss growth.

The chemical control of moss include ferrous sulfate at 4 to 7 pounds per 1000 square feet or ferrous ammonium sulfate at 10 pounds per 1000 square feet. In cool humid weather or with thicker moss, higher rates or repeat applications should be used. The application should thoroughly wet the moss to the soil, but should not be watered in. Congrol is more effective if the grass is mowed low and the area is raked prior to treatment to remove as much moss as possible. The moss should be raked out after it is dead. If large bare spots remain after removal of the moss, they should be seeded or sodded.

III. Shade

- A. It is hard to maintain good turf under trees, especially if they are shallow rooted. Shade affects turfgrass growth through the reduction of light and leads to weak leaf growth. As a result, the turf under a tree is weak, shallow-rooted turf which is prone to wear, disease, and insect injury, and not tolerant of heat, cold, or drought.
- B. Suggestions: The following is a list of suggestions that may improve turf under trees:*

1. Use shade-tolerant grasses.
2. Fertilize the grass frequently, but do not overstimulate with nitrogen.
3. Remove unnecessary trees.
4. Prune the remaining trees heavily to remove dead or low branches, which block light from the grass.
5. Prune shallow-tree roots that compete with the grass for nutrients and moisture. This can be done without harming the tree.
6. Fertilize the trees to keep them from competing with the grass nutrients. Punch holes around the tree 2 to 4 feet deep with a crowbar or a stick as far out as the branches reach. Put fertilizer in the holes.
7. Apply lime if the soil has become strongly acid.
8. Remove fallen limbs and other debris quickly.
9. Fertilize in the early spring to help the grass begin vigorous growth before leaf-shedding trees develop new leaves.
10. When watering, wet the soil at least 6 inches deep.
11. If a turf grass will not grow under trees, plant a ground cover plant there.

*Source: Better Lawns, USDA, Home and Garden Bulletin Number 51.

IV. Soil Compaction

- A. Cause and Results: Soil compaction is concentrated in the top two or three inches of soil and results from traffic across the lawn. When soil is compacted, the end result is a decline in the turf quality.
- B. Correction: Modification with a coarse-textured material is the best way to correct a compacted soil. This approach may be too expensive in many cases, and thus, cultivation may be used. Cultivation allows better air and water movement and exchange. It can also improve resiliency and thatch decomposition.

The four primary methods of cultivation are described below:

1. Coring removes soil cores with a hollow tine or spoon. The remaining hole in the sod is three to four inches deep. The cores can be removed or broken up and matted back into the surface with some kind of heavy steel mat. Coring is one of the most effective cultivation methods because it permits deep penetration of immobile fertilizers such as phosphorus and liming materials. It also prevents the loss of water from surface runoff and promotes good root growth and shoot density.
2. Slicing is a deep, vertical cutting operation which produces a three to four inch deep slit in the soil. Both mechanized slicing and coring units are expensive, but can be rented once or twice a year as needed. Lawns cultivated by slicing lose less water by surface runoff and have good root growth and shoot density.
3. Forking is usually done manually with a three, four, or five tined fork and is especially good for a small area of compaction, such as near the corners of a house. The fork should be pushed six or eight inches into the soil, twisted back and forth and lifted out. This should be repeated over the compacted area.

4. Spiking is the shallow perforation of the surface with a hand or mechanical unit. The spiker usually penetrates only about 1/2 to 3/4 inch into the ground, and thus, is not as effective as the other methods described.

Cultivation should only be practiced when a compaction problem is present. It should be done during the active turfgrass growth periods. For cool season turfgrasses, spring and fall are best for cultivation while spring and summer are desirable for warm season turfgrasses. The soil should be moist when cultivating to receive maximum penetration. Alternate freezing and thawing during winter tends to prevent soil compaction in cool climates.

V. Waterlogged Soils

- A. Cause and Results: Wet, waterlogged soils are caused by poor internal drainage resulting from fine-textured, compacted soils or by a lack of surface drainage. The problem can be made worse with excessive irrigation. Turf will not survive under long periods of waterlogged soils.
- B. Correction: The two areas of drainage--surface and subsurface--are described in the following:
 1. Surface drainage must be adequate for the rapid removal of excess water. A slope of 1 to 2 percent (or one or two feet per 100 feet) is suggested from the house or other building to a street or subsurface drain. Depressions should be avoided since they collect water. Surface drainage should be installed prior to the establishment of the lawn because it is cheaper then. Open drains or channels to carry large volumes of water are other forms of surface drainage.
 2. Subsurface drainage may be required in lawns with poor internal drainage, especially fine-textured clay soils. A drain tile system is the most common procedure for subsurface drainage. The system is composed of tile mains connecting the outlet to a series of parallel ditches, which are about four inches in diameter. The drain tile placement varies with soil texture and layers. Usually, they are placed two to three feet deep, fifteen to sixteen feet apart. The system should fall at least one percent throughout. After the drain tile is placed in a trench, it should be covered with coarse sand or gravel before filling with stockpiled soil. Time should be allowed for the trench to settle before establishing the lawn.

Slit trenches, dry wells, and surface catch basins are other forms of subsurface drainage. These are described in detail on pages 94 and 97 of How to Have a Beautiful Lawn.

VI. Thatch

- A. Effects: Thatch is the accumulation of tightly meshed dead and living stems and roots that build up between the zone of green vegetation and the soil surface. A thatch accumulation of 0.2 to

0.3 inch is beneficial because it increases wear tolerance and resiliency. In moderate amounts, it also insulates the crowns and lateral stems and protects the plant from extreme temperature and drought. When a half inch or more of thatch accumulates, many other problems may be created.

- B. Causes: When the rate of accumulation exceeds the organic matter decomposition rate, thatch develops. Cultural or environmental factors that stimulate shoot growth and/or impair thatch decomposition will also increase thatch accumulation. Factors that contribute to thatching include the following:
1. Acidic soils below a pH of six, which reduces earthworms, insect and micro-organism activity.
 2. Compacted or fine-textured soils with restricted oxygen levels that also impair the activity of decomposing organisms.
 3. Excessive nitrogen or irrigation that stimulate shoot growth.
 4. Infrequent mowing or excessively high cutting heights, particularly with vigorous warm season turfgrasses.
 5. Use of the more vigorous turfgrass varieties.
- C. Preventing Accumulation: An active earthworm population in the lawn should be encouraged as a biological control. Thus, soil insecticides should only be used when needed to control specific pest problems, since many insecticides also kill earthworms. Micro-organism, fungi, insect, and earthworm populations are responsible for thatch decomposition. Keeping soil oxygen levels high on moist soils with proper pH will encourage the organisms that break down thatch.
- D. Thatch Removal: The need for thatch control can be determined by cutting a pie-shaped cross section in the turf, lifting it, and examining the extent of thatch build-up. If the depth is greater than a half inch, steps must be taken to remove it. The procedure used is vertical mowing, which involves vertical rigid (or flexible) blades (or tines) that produce a perpendicular cutting action into the turf, but above the soil surface. Vertical mowing should be timed so that at least thirty days of favorable temperature and moisture follow the operation. It should be avoided during periods that are especially favorable for the germination of weeds.

The amount of thatch removed by vertical mowing depends on both the weight of the machine and the size of the power unit. A vertical mower can be rented for once a year use. These rental units are lightweight, and thus, it may be necessary to go over the lawn two, three, or four times in different directions to remove the accumulated thatch. Larger, professional machines are available and will remove the thatch in one operation. Vertical mowing will bring a large amount of organic material to the surface. This must be hand raked or power swept from the area and then hauled to a disposal site. Immediately following the thatch removal, the lawn should be fertilized and irrigated to promote quick recovery.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:

1. Even well-established thriving lawns may develop problems over time, despite the best efforts of the homeowner.

B. Things to be brought out by class members:

1. Have members describe lawn problems that they have witnessed.

II. Enrichment Activities

- A. Arrange for field trip to examine established lawns suffering from a common problem.
- B. Contact a resource person that may be in the process of correcting a common lawn problem.
- C. Utilize a class member's lawn with a problem and decide upon a solution with the class.

III. Suggested Teaching Materials

A. References and Audiovisuals (Refer to Appendix A)

B. Resource Personnel

1. Extension specialists
2. Local sources (e.g., landscaper)
3. Class member with one or more problems willing to use home situation for class purposes.

Lesson 4

RENOVATING AN ESTABLISHED LAWN

Objective: To develop the ability of homeowners to identify the need for and renovate an established lawn.

Problem and Analysis: How should we identify the need for renovation and how should we renovate an existing lawn?

- Need for renovation
- Steps involved

Content

I. Need for Renovation

- A. A poor existing lawn may have been established by the homeowner himself or inherited from a builder or previous owner. In either case, deciding what to do with a thin, weed infested lawn depends on the cause(s) of deterioration and the content of surviving desirable species. In any renovation program, it is very important to determine the specific problem and then to take steps to solve the problem. The following list includes common problems and corrective practices:*

Common Problems

Heavy clay soil

Too much shade

Mowing too close

Acid soil and/or
improper fertilizationSoil covered with algae
or moss

Weeds

Insect damage

Excessive thatch
(more than $\frac{1}{2}$ " thick)Corrective Practices

Mix organic matter in the surface.

Select more shade tolerant grasses such as the fescues or use an ornamental ground cover.

Make sure mower is set to mow at $2\frac{1}{2}$ " or higher.

Have soil tested and apply suggested lime and fertilizer.

Any of the above problems that cause poor turf growth or excessive surface moisture should be corrected.

Have weeds correctly identified and control them if possible.

Have insects correctly identified and apply insecticide only if insects remain active.

Dethatch lawn in spring or fall when grasses are growing fast.

*Source: Renovating Kentucky Bluegrass and Fescue Lawns, AGR-51, Kentucky Cooperative Extension Service.

The extent of desirable perennial grasses in the existing lawn needs to be considered. A number of lawns could be improved considerably with proper maintenance including cutting height, mowing frequency, fertilization, irrigation, and cultivation. Usually when the desired stand of grasses in a lawn is less than 50%, renovation is required. Renovation can be defined as turfgrass improvement through over-seeding or vegetative planting in an existing lawn without complete re-establishment.

II. Steps Involved*

- A. The most favorable time for renovating a lawn is the same as for establishing a new lawn--late summer and early fall is best with early spring as second best. Rapid, effective renovation is based on good soil/seed contact. The correct combination of the following steps used in renovation can be chosen to fit a specific lawn situation.
 1. Removal of Weeds: If the major problem is a high weed population, one or both of the following approaches may be useful. Weedy grasses, including crabgrass and dallisgrass, can be selectively removed with two applications of an organic arsenical. The applications of DSMA or MSMA should be separated by 10 to 14 days. Most broadleaf weeds can be selectively killed with a combination of 2,4-D and mecoprop. To achieve maximum kill, these selective herbicides should be applied several weeks before seeding or vegetative planting. Plan ahead before undertaking a renovation project.
 2. Removal of Thatch and Dead Vegetation: To achieve good soil/seed contact, it is important to remove considerable thatch. When seeds are distributed over a dead organic layer, the resulting seedling often dies due to lack of moisture. Thatch can be removed by vigorous raking of small areas or by using a power rake or vertical cutting machine for larger areas. For adequate removal of dead vegetation, it may be necessary to go over an area several times. A small amount of organic material can be left on the surface to serve as a light mulch for moisture retention.
 3. Cultivation: Thorough cultivation provides openings in the soil which serve two functions. They will ease soil compaction problems and enhance soil/seed contact. Coring and spiking types of cultivation equipment can be rented for renovation use. Coring is considered the best method because a large quantity of soil is brought to the surface. There it serves as a partial topdressing over the newly planted seed. Two to four trips over the renovation site may be required to reach the desired soil cultivation. Moist soil will allow deeper and more effective cultivation. After coring, a vertical mowing and/or matting will serve to break up the cores and redistribute the soil over the turf.
 4. Correcting Soil Reaction Problems: A soil test is necessary to determine if a soil is excessively acidic or alkaline. Soils with a pH below 5.5 require an application of lime while soils with a pH above 7.5 should receive an acidifying material. Sulfur

*Adapted from How to Have a Beautiful Lawn, pp. 106-107.

is often used to lower the pH in the latter case. The specific amount of a liming or acidifying material should be based on the actual pH as determined by a soil test. The materials should be incorporated into the soil at the time of cultivation to allow them better penetration into the soil. Again, coring is considered the best method of penetration.

5. Fertilization: A soil test should be used to determine the amount of phosphorus and potassium to be used during renovation. If a large quantity of phosphorus is required, it should be applied just after cultivation for maximum penetration. A minimum of 1 pound of nitrogen per 1000 square feet should be included in the fertilization application. If an extreme nutrient deficiency exists, several fertilizer applications may have to be made to the soil after renovation. Large amounts of fertilizer should not be applied prior to planting because of possible toxicity to germinating seedlings. If the soil has not been limed or fertilized previously, then approximately 10 pounds of a 10-10-10 or 10-5-5 fertilizer and about 80 pounds of ground limestone per 1000 square feet should be added.
6. Planting: For successful renovation, high quality seeds and grasses adapted to the particular soil and climate should be selected. Consultation with the County Agricultural Agent or a seed dealer is important in choosing the correct grass or mixture of grasses. A more uniform appearance will be maintained by using the mixture already established in the lawn. A rate of 2 pounds/1000 square feet for Kentucky Bluegrass and 6 pounds/1000 square feet for tall fescue is recommended with an even distribution across the area.

The planting procedure used is determined by the size of the area. Relatively small areas can be seeded with a gravity or centrifugal spreader after dethatching has occurred to ensure good soil/seed contact. Raking and rolling should follow this procedure. For more extensive areas, renovation is best accomplished with larger power equipment. Specialized renovation machines can be rented and are very effective in assuring good soil/seed contact. They provide a dual operation by vertical mowing, grooving, and/or slicing and also inserting the seeds into slits made in the soil by a rolling colter.

7. Rolling: It is important to roll the renovation site immediately following planting to ensure proper soil contact. The use of a medium to light weight water ballast roller is recommended.
8. Irrigation and Proper Care: Following planting and rolling, the area should be watered to a depth of 6 inches. After the initial irrigation, a mid-day irrigation should be practiced for 3 to 4 weeks. When seedlings are 1½ to 2 inches tall, a light application of ½ pound of nitrogen per 1000 square feet will aid the establishment. As the grasses grow higher than the desired 2½ inch mowing height, normal mowing practices should be continued.

If the area is seeded during the spring and crabgrass is a potential problem, a pre-emergent crabgrass herbicide should be applied immediately after seeding. Siduron (Tupersan) is the

only one that can be used at the time of seeding. A second application should be applied in the late spring or early summer to ensure maximum control. The specific label directions should be followed for rates and appropriate methods of use.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:

1. It is not necessary to completely re-do many lawns that have growth problems.
2. Renovation of a lawn is a relatively easy procedure if a person secures the proper equipment and supplies.
3. Compare renovation costs with establishment costs for a member's home site.

B. Things to be brought out by class members:

1. Experiences the members have had with renovation of established lawns.

II. Enrichment Activities

- A. Arrange for field trips to witness lawns requiring renovation or re-establishment.
- B. Visit a site where a professional landscaper is renovating a lawn.
- C. Visit a rental center to examine equipment available for lawn renovation.
- D. Use a class members lawn requiring renovation and have the entire class assist.

III. Suggested Teaching Materials

- A. References and Audiovisuals (Refer to Appendix A)
- B. Resource Personnel
 1. Extension specialists
 2. Local sources (e.g., landscaper)
 3. Class members with lawn problems

APPENDIX A
Unit References

UNIT REFERENCES

Books

How to Have a Beautiful Lawn. James B. Beard, Beard Books, 1812 Shadowood Drive, College Station, Texas, 77840, 1979.

Introduction to Turfgrass Science and Culture -- Laboratory Exercises. James B. Beard and Joseph M. DiPaola, Burgess Publishing Company, 7108 Ohms Lane, Minneapolis, Minnesota 55435, 1979.

Turfgrass Management. A. J. Turgeon, Reston Publishing Company, Division of Prentice-Hall, Reston, Virginia 22090, 1980.

Bulletins, Pamphlets, Filmstrips, and Slides

Cooperative Extension Service, University of Kentucky (publications available from your county extension office)

AGR-1 (Current year) Lime and Fertilizer Recommendations

AGR-7 Guidelines for Sodding

AGR-12 Common Lawn Weeds

AGR-16 How to Take Good Soil Test Samples

AGR-19 Liming Acid Soils

AGR-34 Kentucky Bluegrass and Tall Fescue Varieties for Lawns and Turfs

AGR-51 Renovating Kentucky Bluegrass and Fescue Lawns

AGR-52 Selecting the RIGHT Grass for Your Kentucky Lawn

AGR-53 Lawn Fertilization in Kentucky

AGR-54 Mowing, Dethatching and Watering Kentucky Lawns

AGR-55 Turf Care Calendar for Kentucky Bluegrass and Fescue Lawns

AGR-57 Soil Testing: What it is -- What it does

AGR-78 (Current year) Weed Control Recommendations for Kentucky Bluegrass and Tall Fescue Lawns and Recreational Turf

- ENT-7 Controlling Sod Webworms
- ENT-10 Controlling White Grubs
- PPA-1 Chemical Control of Turfgrass Diseases -- (current year)

Kentucky Department of Education, Competency Based Vocational Education Unit,
Frankfort, Kentucky, Gardening-Groundskeeping Modules

- GG-1 Taking Soil Samples
- GG-8 Preparing a Lawn Seedbed
- GG-9 Applying Fertilizer
- GG-11 Sowing Lawns
- GG-12 Revitalizing and Aerating Sod
- GG-28 Servicing Rotary Type Mower Cutting Blades
- GG-53 Sodding Worn Spots on a Lawn
- GG-54 Mowing Grass
- GG-56 Using a Power Edger
- GG-69 Controlling Insects on Plants
- GG-71 Applying Weed Killing Compounds
- GG-72 Applying Chemicals to Diseased Plants

Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe
Road, The Ohio State University, Columbus, Ohio, 43210

Common Crop and Weed Seeds, slides and script.

Identification Characteristics of 70 Crop and Weed Plants, slides and script.

Lawn Renovation and Reestablishment, slides and script.

Some Common Types of Insects, 26 p.

Turf Diseases of the Midwest, slides and script.

Turf Management, 109 p.

The Pennsylvania State University, Department of Agricultural Education,
102 Armsby Building, University Park, Pennsylvania, 16802

Ornamental Horticulture Task Sheets (series of task sheets in turfgrass,
landscape maintenance and landscape construction areas)

The Time-Life Encyclopedia of Gardening, Reader Information, Time-Life Books,
541 North Fairbanks Court, Chicago, Illinois, 60611

Lawns and Ground Covers, James Underwood Crockett, Time-Life Books, New
York, 1971.

United States Department of Agriculture, Superintendent of Documents, U. S.
Government Printing Office, Washington, D. C., 20402

Home and Garden Bulletin Number 51 -- Better Lawns -- Establishment, Maintenance, Renovation, Lawn Problems, Grasses

Home and Garden Bulletin Number 53 -- Lawn Insects: How to Control Them

Home and Garden Bulletin Number 61 -- Lawn Diseases: How to Control them

Home and Garden Bulletin Number 169 -- How to Buy Lawn Seed

Vocational Agriculture Service, University of Illinois, 434 Mumford Hall,
Urbana, Illinois, 61801

Controlling Weeds, VAS 4042a, 16 p.

Establishing a Lawn, VAS 5008, 8 p.

Identifying Illinois Turfgrasses, filmstrip or slides with script

Identifying and Controlling Lawn Insects, VAS 5016, 16 p.

Lawn Weeds -- Identification and Control, filmstrip with script

Seed Structure and Identification of Cool Season Turfgrasses, filmstrip
with script

Steps to a Better Lawn, filmstrip or slides with script

Turfgrass Diseases and Their Control, VAS 5015, 28 p.

APPENDIX B
Instructional Unit Evaluation

A Questionnaire for Kentucky Vo-Ag Teachers of Adults

How many years of teaching experience do you have? _____

How many years have you taught adults in agriculture? _____

How long has it been since you have taken your last college classwork in agriculture? _____;
in education _____; (undergraduate, graduate, or non-credit course)? _____

What is the highest degree you hold? _____

How many teachers are in your department? _____

What age level students do you teach? (☒ one)
a) _____ high school only b) _____ high school and adult c) _____ adult only

How many other units from the University of Kentucky have you used in your teaching during
the past few years? _____

NAME OF UNIT EVALUATED? _____

TYPE OF CLIENTELE TAUGHT: _____ Adult Farmer _____ Young Farmer
_____ Other Adults (please specify) _____

Average number attending class _____

Was the interest level _____ high? _____ moderate? _____ low?

How many lessons did you use? _____ How many class periods? _____

Indicate any lesson you added or deleted _____

Directions: Place a check mark (✓) in the appropriate left hand column to rate the following components of the unit based on your own observations. A ranking of 5 represents an excellent rating decreasing to a rank of 1 for poor. For the open-ended questions please write on the back if additional space is needed.

5 4 3 2 1
E . P

_____	General arrangement of parts
_____	Appropriateness of format for teaching adults
_____	Lengths of the unit
_____	Usefulness of suggestions for using the unit
_____	Number of lessons
_____	Order of lessons
_____	Specific comments:

49

Objectives in the Unit

5 4 3 2 1
E P

Clearly stated
Reasonable to reach in the allotted time
Relevant to needs of the adult learner
Specific comments: _____

Technical Content

5 4 3 2 1

Sufficiently detailed for direct use in class
Related to objectives
Divided into appropriate problem areas
Up-to-date
Accuracy
Reasonably complete
Specific comments: _____

Suggestions for Teaching the Lessons

5 4 3 2 1

Appropriate information for the teacher to bring out
Appropriate items to be secured from class members
Suitability of enrichment activities
Specific comments: _____

Resources and Teaching Aids in the Unit

5 4 3 2 1

Up-to-date
Accessibility to the teacher
Relevance to the unit
Adaptability to the teaching plan
Specific comments: _____

With what parts of the unit do you feel you need additional help?

_____ None of them
_____ Objectives
_____ Content
_____ Course organization and planning
_____ References
_____ Resources and teaching materials
_____ Teaching methods
_____ Other (Specify) _____

PART III -- GENERAL REACTION

Please indicate any other strengths and weaknesses that you have observed in the unit and any suggestions for improvement, revision, and/or implementation (use additional sheet if needed).